

U.S.S.N. 10/762,119
Attorney Docket No.: 2000-0062-03

1. (Amended) An electric discharge narrow band gas laser with minimized wavelength variations caused by fluctuations in laser gas density resulting in laser beam directional changes comprising: A) a laser chamber, B) an elongated electrode structure enclosed within said chamber comprising an elongated anode and an elongated cathode separated by a distance defining a discharge region, said discharge region defining a long dimension in a beam direction, C) a laser gas contained in said chamber, D) a fan for circulating said laser gas within said chamber and through said discharge region, E) an output coupler and a line narrowing module defining a resonant cavity and laser beam direction, F) two chamber windows having surfaces oriented substantially parallel to the surfaces of each other and at an angle between 40° and 70° with said beam direction, and, G) a fast beam deflection monitoring means to monitor deflection of said ~~test~~ laser beam.

2. (Original) A laser as in claim 1 wherein said angle is approximately equal to Brewster's angle for the laser gas and window materials.

3. (Original) A laser as in claim 1 wherein said angle is about 45°.

4. (Previously presented) A narrow band electric discharge gas laser with minimized wavelength variations caused by fluctuations in laser gas density resulting in laser beam directional changes comprising: A) a laser chamber, B) an elongated electrode structure enclosed within said chamber comprising an elongated anode and an elongated cathode separated by a distance defining a discharge region in which a discharge laser beam is amplified, said discharge region defining a long dimension in a beam direction, C) a laser gas contained in said chamber, D) a fan for circulating said laser gas within said chamber and through said discharge region, E) an output coupler, F) a grating based line narrowing module comprising a grating and a tuning means to control direction of illumination of light from said chamber on said grating, said direction of illumination defining an illumination direction, G) a fast beam deflection monitoring means to monitor deflection of said laser beam; and H) a feedback control means for controlling said tuning means based on signals from said beam

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deflection monitoring means.

5. (Cancelled)

6. (Cancelled)

7. (Cancelled)

8. (Original) A laser as in claim 1 and further comprising a pulse energy control means for minimizing pulse energy fluctuations caused by discharge laser beam fluctuations in a vertical direction.

9. (Previously presented) A laser as in claim 16 wherein said pivoting mirror includes means for pivoting about each of two axis and said feedback control means includes means for controlling degrees of pivot about two axes based on signals from said beam deflection monitoring means.

10. (Original) A laser as in claim 4 wherein said feedback control means includes means for pretuning said discharge laser prior to beginning of lasing operation.

11. (Original) A laser as in claim 4 wherein said feedback control means includes means for correcting for wavelength drift during idle periods of said discharge laser.

12. (Cancelled)

13. (Cancelled)

14. (Cancelled)

15. (Cancelled)

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16. (Previously presented) A laser as in claim 4 wherein:

said tuning means is a pivoting mirror.

17. (Previously presented) A laser as in claim 16 and further comprising a pulse energy control means for minimizing pulse energy fluctuations caused by discharge laser beam fluctuations in a vertical direction.

18. (Previously presented) A laser as in claim 17 wherein said pivoting mirror includes means for pivoting about each of two axis and said feedback control means includes means for controlling degrees of pivot about two axes based on signals from said beam deflection monitoring means.

19. (Previously presented) A laser as in claim 16 wherein said feedback control means includes means for pretuning said discharge laser prior to beginning of lasing operation.

20. (Previously presented) A laser as in claim 16 wherein said feedback control means includes means for correcting for wavelength drift during idle periods of said discharge laser.

21. (Amended) An electric discharge gas laser comprising: A) a laser chamber, B) an elongated electrode structure enclosed within said chamber comprising an elongated anode and an elongated cathode separated by a distance defining a discharge region, said discharge region defining a long dimension in a beam direction, C) a laser gas contained in said chamber, D) a fan circulating said laser gas within said chamber and through said discharge region, E) an output coupler and a line narrowing module defining a resonant cavity and laser beam direction, F) two chamber windows having surfaces oriented substantially parallel to the surfaces of each other and at an angle between 40° and 70° with said beam direction, and G) means for reducing the impact of discharge produced pressure waves reflected within the chamber upon returning to the discharge region having means for reducing the net index of refraction gradients produced in the beam when the reflected pressure wave returns to the

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discharge region.

22. (Previously presented) An electric discharge gas laser comprising: A) a laser chamber, B) an elongated electrode structure enclosed within said chamber comprising an elongated anode and an elongated cathode separated by a distance defining a discharge region in which a discharge laser beam is amplified, said discharge region defining a long dimension in a beam direction, C) a laser gas contained in said chamber, D) a fan circulating said laser gas within said chamber and through said discharge region, E) an output coupler, F) a grating based line narrowing module comprising a grating and a tuning means for controlling the direction of illumination of light from said chamber on said grating, said direction of illumination defining an illumination direction, G) a fast beam deflection monitoring means for monitoring deflection of said discharge laser beam; H) a feedback control means for controlling said tuning means based on signals from said beam deflection monitoring means; I) said tuning means comprising a pivoting mirror; and J) means for reducing the impact of discharge produced pressure waves reflected within the chamber upon returning to the discharge region.

23. (Amended) An electric discharge gas laser comprising: A) a laser chamber, B) an elongated electrode structure enclosed within said chamber comprising an elongated anode and an elongated cathode separated by a distance defining a discharge region, said discharge region defining a long dimension in a beam direction, C) a laser gas contained in said chamber, D) a fan circulating said laser gas within said chamber and through said discharge region, E) an output coupler and a line narrowing module defining a resonant cavity and laser beam direction, and, F) means for reducing the impact of discharge produced pressure waves reflected within the chamber upon returning to the discharge region having means for reducing the net index of refraction gradients produced in the beam when the reflected pressure wave returns to the discharge region.

24. (Cancelled)

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25. (previously presented) The apparatus of claim 22 further comprising:

the means for reducing the impact of discharge produced pressure waves further comprises means for reducing the net index of refraction gradients produced in the beam when the reflected pressure wave returns to the discharge region.

26. (Cancelled)

27. (Previously presented) The apparatus of claim 21 further comprising:

the means for reducing the impact of discharge produced pressure waves further comprises means for reducing the impact to the discharge region of the reflection of the pressure waves from the chamber walls.

28. (Previously presented) The apparatus of claim 22 further comprising:

the means for reducing the impact of discharge produced pressure waves further comprises means for reducing the impact to the discharge region of the reflection of the pressure waves from the chamber walls.

29. (Previously presented) The apparatus of claim 23 further comprising:

the means for reducing the impact of discharge produced pressure waves further comprises means for reducing the impact to the discharge region of the reflection of the pressure waves from the chamber walls.

30. (Previously presented) An electric discharge gas laser comprising: A) a laser chamber, B) an elongated electrode structure enclosed within said chamber comprising an elongated anode and an elongated cathode separated by a distance defining a discharge region, said discharge region defining a long dimension in a beam direction, C) a laser gas contained in said chamber, D) a fan circulating said laser gas within said chamber and through said discharge region, E) an output coupler and a line narrowing module defining a resonant cavity and laser beam direction, F) two chamber windows having surfaces oriented substantially parallel to the surfaces of each other and at an angle between 40° and 70° with said beam direction, G) a

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fast beam deflection monitor monitoring deflection of said beam, and H) a bandwidth stabilizer reducing the impact upon returning to the discharge region of discharge produced pressure waves reflected within the chamber.

31. (Previously presented) A narrow band electric discharge gas laser with minimized wavelength variations caused by fluctuations in laser gas density resulting in laser beam directional changes comprising: A) a laser chamber, B) an elongated electrode structure enclosed within said chamber comprising an elongated anode and an elongated cathode separated by a distance defining a discharge region in which a discharge laser beam is amplified, said discharge region defining a long dimension in a beam direction, C) a laser gas contained in said chamber, D) a fan circulating said laser gas within said chamber and through said discharge region, E) an output coupler, F) a grating based line narrowing module comprising a grating and a tuning mechanism controlling the direction of illumination of light from said chamber on said grating, said direction of illumination defining an illumination direction, G) a fast beam deflection monitor monitoring deflection of said laser beam; H) a feedback controller controlling said tuning mechanism based on signals from said beam deflection monitor; I) said tuning mechanism comprising a pivoting mirror; and J) a bandwidth stabilizer reducing the impact upon returning to the discharge region of discharge produced pressure waves reflected within the chamber.

32. (Amended) An electric discharge narrow band gas laser comprising: A) a laser chamber, B) an elongated electrode structure enclosed within said chamber comprising an elongated anode and an elongated cathode separated by a distance defining a discharge region, said discharge region defining a long dimension in a beam direction, C) a laser gas contained in said chamber, D) a fan circulating said laser gas within said chamber and through said discharge region, E) an output coupler and a line narrowing module defining a resonant cavity and laser beam direction, and, F) a bandwidth stabilizer reducing the impact upon returning to the discharge region of discharge produced pressure waves reflected within the chamber having a refraction gradient reduction mechanism reducing the net index of refraction gradients produced in the beam when the reflected pressure wave returns to the

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discharge region.

33. (Previously presented) The apparatus of claim 30 further comprising:

the bandwidth stabilizer further comprises a refraction gradient reduction mechanism reducing the net index of refraction gradients produced in the beam when the reflected pressure wave returns to the discharge region.

34. (Previously presented) The apparatus of claim 31 further comprising:

the bandwidth stabilizer further comprises a refraction gradient reduction mechanism reducing the net index of refraction gradients produced in the beam when the reflected pressure wave returns to the discharge region.

35. (Cancelled)

36. (Previously presented) The apparatus of claim 30 further comprising:

the bandwidth stabilizer further comprises a pressure wave impact reducer reducing the impact to the discharge region of the reflection of the pressure waves from the chamber walls.

37. (Previously presented) The apparatus of claim 31 further comprising:

the bandwidth stabilizer further comprises a pressure wave impact reducer reducing the impact to the discharge region of the reflection of the pressure waves from the chamber walls.

38. (previously presented) The apparatus of claim 32 further comprising:

the bandwidth stabilizer further comprises a pressure wave impact reducer reducing the impact to the discharge region of the reflection of the pressure waves from the chamber walls.

39. (Previously presented) The apparatus of claim 30 further comprising:

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the bandwidth stabilizer further comprises a pressure wave impact reducer reducing the impact to the discharge region of the reflection of the pressure waves from one or more reflecting mechanisms within the chamber.

40. (Previously presented) The apparatus of claim 31 further comprising:

the bandwidth stabilizer further comprises a pressure wave impact reducer reducing the impact to the discharge region of the reflection of the pressure waves from one or more reflecting mechanisms within the chamber.

41. (Previously presented) The apparatus of claim 32 further comprising:

the bandwidth stabilizer further comprises a pressure wave impact reducer reducing the impact to the discharge region of the reflection of the pressure waves from one or more reflecting mechanisms within the chamber.